Topics Spring 2014
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Overview

The aim is to cover enough duality theory to comfortably use a variety of results in dynamic programming, monotone comparative statics, econometrics, and infinite games.

a) The first two of these four topics keep us within the set of continuous functions and will provide answers to the following questions: "What properties of a continuous stage reward function does the dynamic programming value function inherit?" and "What kinds of partial orders on continuous expected utility functions deliver monotone comparative statics results for choice under uncertainty?"

b) The second two topics will require us to acquire some knowledge of measurable functions and will provide answers to the following questions: "What are the commonalities in the various (mis-)specification tests for econometric models?" and "What goes into 'informational continuity' for infinite games?"

The duality constructs and theory applies both to spaces of continuous functions and to spaces of measurable functions: cones, dual cones, and polar sets, and polar topologies in spaces of functions. We will first cover all of these ideas in the simplest setting, the finite dimensional case, $\mathbb{R}^{\ell}$, understood as the set of continuous and/or measurable functions on an ℓ-point set.

Outline

I. Duality and continuous functions.
   - A. Background.
     1. Ch. I and II.$1-5$ in Robertson, A. P. and Robertson, W. (1980). *Topological vector spaces*, volume 53 of *Cambridge Tracts in Mathematics*. Cambridge University Press, Cambridge, second edition
     2. Parts of Ch. 6 in Corbae, D., Stinchcombe, M. B., and Zeman, J. (2009). *An introduction to mathematical analysis for economic theory and econometrics*. Princeton University Press, Princeton, NJ
   - B. Applications
     1. Dynamic programming: Smith, J. E. and McCardle, K. F. (2002). Structural properties of stochastic dynamic programs. *Operations Research*, 50(5):796–809
     2. Monotone comparative statics: Athey, S. (2002). Monotone comparative statics under uncertainty. *The Quarterly Journal of Economics*, 117(1):187–223
     3. Comparisons of optima: Milgrom, P. (1994). Comparing optima: Do simplifying assumptions affect conclusions? *Journal of Political Economy*, 102(3):607–15
II. Duality and measurable functions.
   - A. Background.
     1. Ch. I and II.$1-5$ in Robertson, A. P. and Robertson, W. (1980). *Topological vector spaces*, volume 53 of *Cambridge Tracts in Mathematics*. Cambridge University Press, Cambridge, second edition

    2. Ch. $1.1 - 4$ in Billingsley, P. (1999). *Convergence of probability measures.* Wiley Series in Probability and Statistics: Probability and Statistics. John Wiley & Sons Inc., New York, second edition. A Wiley-Interscience Publication

    3. Parts of Ch. 8 and 9 in Corbae, D., Stinchcombe, M. B., and Zeman, J. (2009). *An introduction to mathematical analysis for economic theory and econometrics.* Princeton University Press, Princeton, NJ

  B. Applications

    1. Equality constraints on conditional moments and specification testing: Stinchcombe, M. B. and White, H. (1998). Consistent specification testing with nuisance parameters present only under the alternative. *Econometric theory*, 14(3):295–325

    2. <u>In</u>-equality constraints on conditional moments and specification testing: Andrews, D. W. K. and Shi, X. (2013). Inference based on conditional moment inequalities. *Econometrica*, 81(2):609–666

    3. Infinite games with differential information: Milgrom, P. R. and Weber, R. J. (1985). Distributional strategies for games with incomplete information. *Math. Oper. Res.*, 10(4):619–632

    4. Correlated equilibria: recent results simplifying Stinchcombe, M. B. (2011). Correlated equilibrium existence for infinite games with type-dependent strategies. *J. Econom. Theory*, 146(2):638–655

III. Possible additional topics.

  A. Similarity of information structures: Blackwell, LeCam, Boylan

  B. Filtrations: Kreps, Harrison-Kreps, Harrison-Pliska

ORGANIZATION

I will cover most of the background material in a lecture format. There will be graded assignments making sure you know how to use it. We will divide the presentation of the applications papers between the students according to interests.